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13. ABSTRACT *(Maximum 200 words)*

A systematic set of experiments has been performed to determine the effect of temperature, oxygen, precursor composition, and precursor flow rate on the gas phase of chemical vapor deposition.

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Progress Report For A.F.O.S.R.

Progress has been made in the understanding, further refinement, and preventive maintenance of the chemical vapor deposition (CVD) system. A systematic set of experiments have been performed to determine the effect of temperature, oxygen, precursor composition, and precursor flow rate on the gas phase and *in situ* temperature of the process. Further refinement to the process was accomplished by adding two furnaces which can be heated up to 1200°C: one to desize the fiber before being coated, and a second furnace to serve as the reactor. This allowed the three zone furnace which was originally ineffectively used as a reactor to be used as an in-line heat treatment furnace at temperatures up to 1500°C.

As part of a preventive maintenance effort, a pneumatic valve was added to the sample gas inlet of the mass spectrometer. The pneumatic valve was interfaced to the computer system; and custom software was added to allow the operator to open or close the valve as needed. This prevents the sampling port from being open unnecessarily which could lead to permanent damage to the roughing pump if it happens over an extended period of time. An ion gauge and corresponding controller was added to the vacuum column to monitor the vacuum to prevent damage to the turbo molecular pump by operating it at an unacceptably poor vacuum. The vacuum is also interfaced to the computer as the mass spectrometer intensity is known to be dependent on pressure. Finally, a problem was detected when the turbo molecular pump would not start - after more than a week of troubleshooting it was correctly determined that two capacitors in the power supply were bad and promptly replaced. Fixing the problem prevented the shipment of the instrument back to the factory at a considerable expense and inconvenience.

Using the data acquired from the systematic set of experiments, a fuzzy logic controller was developed to regulate the *in situ* temperature of the process by varying the oxygen flow rate entering the reactor. Prior to actually regulating the temperature, a controller was developed which would use the mass spectrometer and regulate the gas phase with oxygen. These results are being published and being considered for filing of a patent.

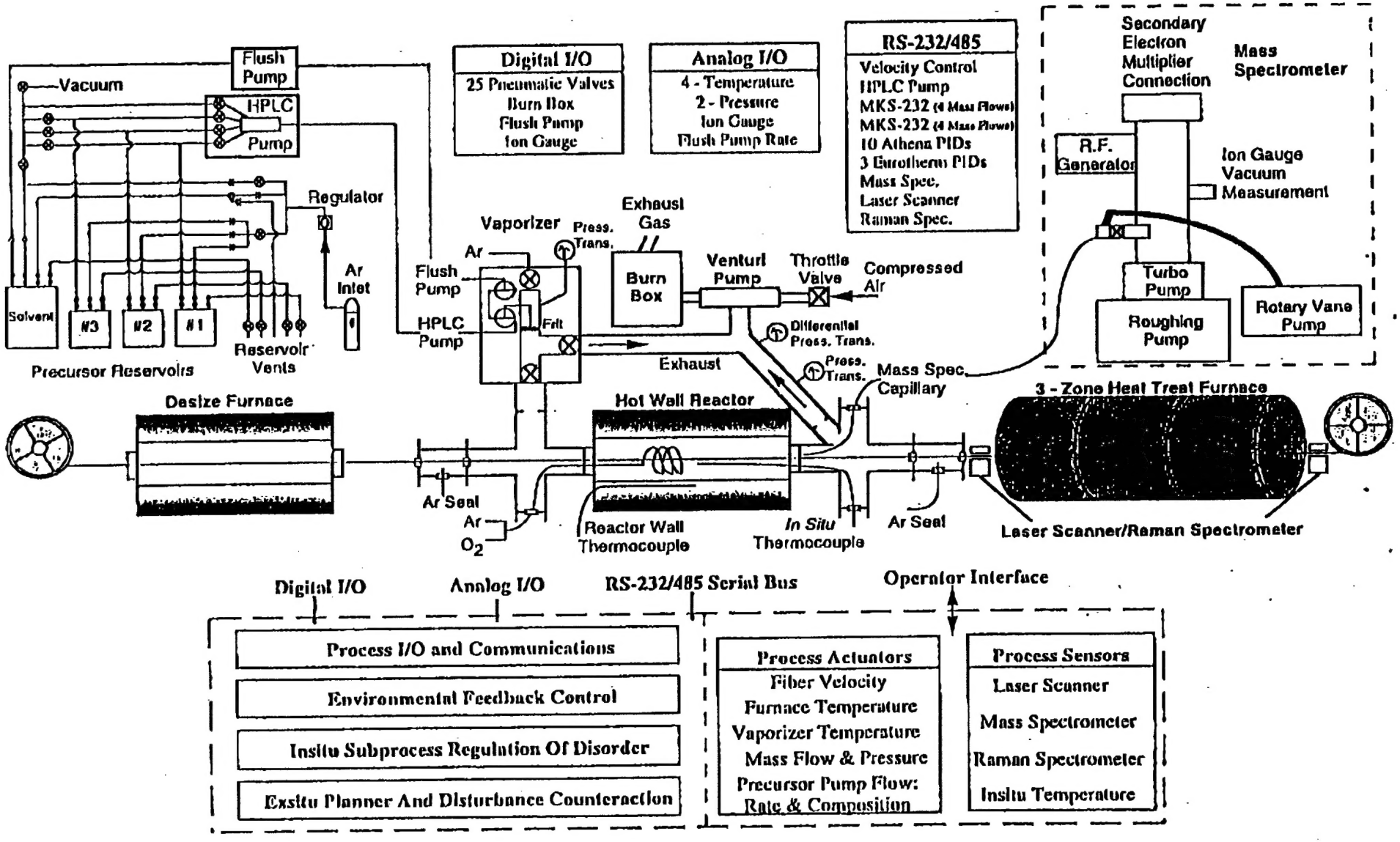

Figure 1a. Molecular Materials Process Plan View